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(54) AIR PRESSURE OPERATED DISPENSER

(71) We, CIBA-GEIGY A.G., a body corporate, organised according to the laws of Switzerland of CH-4002 Basle, Switzerland, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a dispenser for aspirating a fluid and dispensing it as a spray by means of a propellant.

The art of dispensing fluids is very highly developed. More recently there have been great advances in the art of dispensing fluid materials by means of a compressed propellant while keeping the fluid and propellant separate prior to dispensing. These recently developed so-called double aerosol type dispensers are quite satisfactory, but nevertheless have some disadvantages, particularly where they must be made in small sizes. Many of these disadvantages are also common to the single phase dispensers, where the propellant and the material to be dispensed are stored in the mixed condition in the dispenser prior to dispensing.

Among these disadvantages is leakage of propellant from the propellant cartridge during storage, which reduces the shelf life of the dispenser. Additionally, the problem of exactly matching the amount of propellant with the amount of material to be dispensed is often difficult because of this leakage problem. Also, because of differences between the various materials being dispensed, a proper amount of propellant for one material will not suffice or will be in excess of that necessary for dispensing all of another material. In the first instance, part of the product is wasted, and in the second instance, part of the propellant is wasted.

In addition, if it is desired to dispense only a measured quantity of material, special valving means must be developed. Otherwise, the amount of material dispensed is proportional to the time of actuation of the device, and there is no way to accurately ensure that

the user will properly time the actuation to dispense the desired measured quantity.

A further disadvantage is that with compressed gas type propellants, when the propellant is running low, the dispensing of the last of the material to be dispensed can be carried out only at a very slow rate, as compared to when the dispenser is initially filled with propellant, when dispensing takes place rapidly.

Moreover, when conventional aerosol propellants are used to dispense medicaments in inhaler type devices, potentially toxic propellants are inhaled by the user along with the medicament. In many cases, this is undesirable and pharmaceutical marketers would prefer to have the product dispensed by air instead of a chemical vapour conventionally used as propellants.

Many of these disadvantages could be overcome if, instead of using compressed conventional propellant gases, air were used as a propellant and were compressed each time the dispensing operation was to be carried out. Conventional squeeze bulb and piston-cylinder atomizers operate somewhat in this fashion, but have the serious drawback that the compression is carried out gradually, and the aspiration is thus gradual, the amount of material being dispensed being dependent on how fast and with what force the squeeze bulb or the piston-cylinder means is operated.

It is an aim of the present invention to provide a dispensing device which utilizes compressed air for aspiration in a manner so as to overcome all of the recited disadvantages of the aerosol type dispenser.

It is a further aim of the present invention to provide a dispensing device which utilizes compressed air that is compressed each time dispensing takes place, but which releases the compressed air suddenly only after the pressure has been built up to the maximum.

It is a still further aim of the present invention to provide a dispensing device

which utilizes compressed air for dispensing, which dispenses a measured amount of material at each actuation of the device, which is extremely safe to use, and which cannot dispense more than the measured amount of material.

It is a still further aim of the present invention to provide a dispensing device which has a shelf life limited only by the life of the material to be dispensed, and which can also be stored without fear of an explosion of a compressed propellant.

It is a further aim of the present invention to provide such a dispensing device which can be combined with an impregnating device for impregnating articles with a dispensed material.

These aims are sought to be achieved by an aerosol dispenser according to the invention which comprises at least one product container, a manually operable piston pump for producing compressed air to serve as propellant, a dispensing nozzle means through which, in use, compressed air flows and aspirates the product(s) from said container(s), and wherein the flow paths of propellant and of product(s) are controlled by a valve assembly which comprises a valve housing, a displaceable valve stem which is in engagement with respective obturators for the compressed air and for the product(s), the piston of the pump having rigidly connected thereto an abutment surface so disposed as to abut an actuator for the displaceable valve stem at the end of the compression stroke of the piston, the abutment causing the displacement of the valve stem and thus the opening of at least that obturator which controls the flow of compressed air.

In a manner known per se, the valve shaft is preferably provided with a central channel being part of one of the said flow paths, one end of which channel is controlled by one of the said obturators.

The piston is preferably provided with a piston rod protruding from the cylinder by the end thereof away from the said valve housing, and the said actuator is linked to the piston rod, and the piston rod is provided with a duct for delayed balancing of air pressure in said cylinder, which duct is optionally provided with a check valve adapted for closing said duct during the compression stroke of the piston and outflow of compressed air from said cylinder.

In a first preferred embodiment of the dispenser according to the invention, the cylinder is connected with its open end located at the compression side thereof, to an inner front face of the valve housing and the product container is connected to the same front face or to an adjacent side wall of the valve housing so as to surround the cylinder at least on part of the latter's surface, and the dispensing nozzle is borne by the

end of the valve shaft protruding from the opposite front wall of the valve housing.

Preferably, the or each container for product comprises an outer container provided with inlet means for the outside air, and at least one product bag of flexible, collapsible or contractible material, which bag is connected to the product flow path through the valve housing to the dispensing nozzle, and is housed in the said outer container.

The actuator preferably comprise a sleeve means engaging the valve stem as well as at least two levers, a first one thereof being pivotally mounted on the valve housing and engaging the sleeve means, and the second lever being pivotally mounted at a free end of the said first lever and engaging an actuator, preferably a push-button, so as to be moved thereby at an intermediate position of said piston in said cylinder.

Advantageously, a gripping means may be provided at the product container or at the valve housing, serving as counterbearing when said actuating means is actuated, and the piston rod may protrude from the cylinder via a passageway in the bottom of said container and bear push-button means as actuating member at the free piston rod end.

According to a further preferred feature of the invention, the above-mentioned second lever extends about the container and the cylinder which is at least partially surrounded by the former, and this second lever is provided at its end remote from its pivot with a catch means adapted for being engaged by the said push-button means of the piston rod, whereby the push-button means lifts the second lever, beginning from an intermediate position of the said piston in the cylinder, thereby shifting the above-mentioned first lever to move the valve shaft via the said sleeve means toward the interior of the valve housing, and thereby to actuate the obturating means to open the flow paths for compressed air flowing from the cylinder, and for product from the container, both flowing to the dispensing nozzle.

In the above-mentioned preferred embodiment of the invention, there is provided a single valve stem the central channel of which is part of the propellant flow path, and which valve shaft is adapted to actuate the said obturating means controlling both the propellant flow path and the product flow path.

The aims of the present invention are also sought to be attained by the provision of a second embodiment of a dispenser having the above described main features which is, however, characterized by the fact that the cylinder is connected with its open end, located at the compression side thereof, to a front face of the valve housing while the container for the product is connected to a wall of the said valve housing opposite the said front face, that the dispensing nozzle is mounted

in or on a lateral wall of the said valve housing, and that in connection with said valve housing, there are provided two valve shafts, one of which actuates the obturating means controlling the flow path of compressed air from said cylinder to said dispensing nozzle. the other shaft actuating the obturating means controlling the product flow path.

In this embodiment, the valve assembly constitutes a coupler-aspirator unit having two flow passages therein which communicate with a nozzle insert. The first of these flow passages couples to and is adapted to communicate with the stem of the valve of a product container. A guide member is provided which fits over the top of the product container and encloses the valve assembly (coupler-aspirator unit). The actuating member at the free end of the said piston rod is biased by means of a spring device supported by the valve housing and urging the piston rod and piston toward a position of decompression in the said cylinder.

The inner wall of the guide member is provided with a stop means, e.g. ridges, upon which resilient holding means of the valve housing, e.g. notched wing portions, hold the valve housing when the actuating means is not actuated, and the holding member becomes disengaged from the said stop means, when the actuating means is actuated, whereby the valve housing moves the valve shaft which in turn actuates the obturating means controlling the product flow path, so that product can be aspirated from the container to the dispensing nozzle; a return spring member is provided which, upon actuation of the said actuating means having ceased, returns the last-mentioned valve shaft and the valve housing toward their initial position and causes the holding means to reengage the stop means.

The coupler-aspirator unit extends toward and sprays through a hole in the said guide member.

As in the first preferred embodiment of the invention, a compressed air piston-cylinder assembly is provided which includes a cylinder which couples to the coupler-aspirator. Between an inwardly extending flange of the cylinder and the coupler-aspirator is positioned a flexible annular gasket. A hollow valve stem having radial openings therein is positioned for longitudinal movement within a chamber formed in the coupler-aspirator unit and in communication with the second flow passage. The inner periphery of the gasket serves to obturate the radial openings of the valve stem. A piston is adapted to slide within the cylinder. Integral with the piston is a piston rod having an outwardly extending flange which forms the actuating member. Integral with the actuating member is a downwardly extending flange which is concentric around the piston. The down-

wardly extending flange is adapted to slide within the inner surface of the guide member.

The lower surface of the downwardly extending flange is bevelled to contact the bevelled upper surface of the notched wing portions of the coupler-aspirator unit thereby to force the wing portions off the ridges of the guide member. As the actuating member is depressed, the piston slides down within the cylinder, compressing the air therein. When the piston reaches the bottom of the cylinder and maximum air compression is achieved, the valve stem is forced downwardly thereby causing the radial openings to be unblocked. The compressed air within the cylinder is then open through the radial openings, into the second flow passage of the coupler-aspirator and into the nozzle thereof. As the piston is moved downwardly, so is the downwardly extending flange. When the bevelled edge portion of the downwardly extending flange contacts the wing portions, the wing portions are forced away from the ridges on the interior of the guide. The coupler-aspirator is then free to be moved downwardly with the continued application of force to the actuating member. As this occurs, the product container valve is opened. Thus, the product is free to flow through the product container valve into the first flow passage in the coupler-aspirator and through the nozzle. Therefore, the compressed air will aspirate the product through the coupler-aspirator.

The dispenser described above is self-contained and can be used to dispense a material, such as a medicament or a deodorant, directly to the location at which it is to be used. However, the dispenser also lends itself to combination with other apparatus specifically designed to utilize a spray of dispensed material. One such apparatus is a device for impregnating an article with a spray of gaseous material, for example impregnating a cigarette with an aromatic or anticarcinogenic material.

According to this preferred embodiment of the invention, for impregnating an article with a gaseous substance, there is provided an aerosol dispenser as set forth above and including a narrower and a wider member in telescopic association with each other, the said narrower member having a smooth exterior surface and being provided at its one end with a piston head located inside a cavity of the wider member, and the latter member being slidable on the said piston head and having a circumferential piston at its end surrounding the said narrower member which piston has an internal periphery complementary in shape to and in sliding engagement with said smooth exterior surface on said narrower member, said narrower member being an article holder the hollow interior of

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which is sealable against the outside and said wider member being associated with a dispenser unit adapted for dispensing into the interior of said article holder a gaseous substance with which an article held in said interior is to be impregnated.

5 An impregnating device according to this aspect of the invention preferably possesses release means which are provided between the aforesaid piston head and the said valve assembly and normally hold them spaced from each other; as well as switch means provided at the wider telescopable member for moving the said release means to permit the dispenser unit to move toward said article holder and thereby to move the valve stem relative to the valve housing for causing the said obturating means to open the flow paths when the air compressor piston is moved to the inner end of the cylinder adjacent the said valve assembly, as the wider member is moved in telescoping movement relative to the article holder.

25 More in particular, in a preferred embodiment, the release means comprise a pair of release fingers pivotally mounted on the bottom of the piston head and having cam heads on the ends thereof toward the said valve stem, the outer ends of these fingers extending outwardly and bearing against the inner wall surface of the wider telescopable member; the aforesaid cam heads have a shape such that with the fingers engaged with the wall of the wider member, the piston head is spaced from the valve assembly a distance such that the valve stem is in a position in which the flow paths are obturated, and when the fingers are freed from the inner wall of the wider member by the said switch means engaging the fingers and pivoting them, the valve assembly is free to move toward the piston head.

45 In a particularly preferred construction of the impregnating device, the separable bottom portion is removably attached to the wider telescopable member, whereby this bottom portion can be detached from the wider member, and the valve assembly, cylinder and product container in the member can be replaced.

50 In a similar manner as in the embodiments of the first-described aspect of the invention, the air-compressor piston is preferably provided with a duct for delayed equalization of air pressure in the said cylinder, which duct is provided with a check valve adapted for closing the said duct during the compression stroke of the air-compressor piston and outflow of compressed air from said cylinder.

60 Advantageously, the air-compressor piston may be mounted on a separable bottom portion of the wider telescopable member and the dispenser unit is disposed slidably therein with the said air-compressor piston adapted

to be displaceable in the cylinder, as mentioned hereinbefore.

The invention will be described in detail in the following description thereof, with reference to the accompanying drawings, in which:

Fig. 1 is a sectional elevation view of a first embodiment of the dispenser according to the present invention, with the parts in position for the start of a dispensing operation;

Fig. 2 is a sectional elevation view of the upper part of the device shown in Fig. 1;

Fig. 3 is a view similar to Fig. 2 in which the parts are shown in their positions at the end of a dispensing operation;

Fig. 4 is a front view partially in elevation and partially in cross-section of a second embodiment of the dispenser according to the present invention;

Fig. 5 is a side view partially in elevation and partially in cross-section of the dispenser of Fig. 4;

Fig. 6 is a view similar to Fig. 4, but with the dispenser in the actuated position;

Fig. 7 is an enlarged cross-sectional view of the high pressure valve used in accordance with the present invention; and

Fig. 8 is a cross-sectional view taken along line VIII—VIII of Fig. 4;

Fig. 9 is a partial cross-sectional illustration of a product container in accordance with the second embodiment of the present invention as shown in Figures 4 to 8, wherein the product is contained in a flexible product sac;

Fig. 10 is a partial cross-sectional illustration of a product container in accordance with the second embodiment of the present invention as shown in Figures 4 to 8, wherein the product is housed in the product container;

Fig. 11 is a sectional elevation view of a device for impregnating an article with a spray of gaseous material with the parts in their positions at the start of an impregnation operation; and

Fig. 12 is a view similar to Fig. 11 with the parts shown in their positions at the end of an impregnation operation.

Referring first to Figs. 1 to 3, there is shown a first embodiment of a dispenser according to the invention. The dispenser is constituted in the main by a valve assembly, a piston-cylinder assembly, a product-containing sac, a casing enclosing these elements, and actuating means.

The valve assembly is similar to that disclosed in German Published Patent Application No. 1,917,083 published in Germany on October 23, 1969, and in South African Patent No. 69/2314. It has a valve housing 10 having a hollow interior forming a central passageway 11, which opens out of the top of the valve housing 10. A bore 12

extends downwardly from the hollow interior 11 and opens into a downwardly open recess 13 in the bottom of the valve body 10. Positioned in the downwardly open recess 13 is an annular obturating gasket 14.

A hollow valve stem 15, which is shown in partial sectional view in Fig. 1 and in full sectional view in Fig. 2, extends through the hollow interior 11, and has a cylindrical portion 18 extending through the bore 12 and spaced only slightly therefrom, so that the surface defining the bore 12 forms a loose bearing for the valve stem 15. A stem head 16 is provided on the bottom end of the stem 15, and between the cylindrical portion 18 and the stem head 16 is a reduced diameter portion 19 forming an annular groove in which the inner edge of the annular gasket 14 is tightly engaged.

The stem 15 has a hollow bore 17 therein, and from the lower end of the bore 17 extend axial passages 20, which open out of the stem in the groove formed by reduced diameter portion 19. In the non-dispensing position of the dispenser, as shown in Fig. 1, in which the stem 15 is in the raised position relative to the valve housing 10, the inner edge of the annular gasket 14 closes off or obturates the openings at the lower ends of the axial passages 20.

The valve stem 15 has a flange 21 thereon. A return spring 23 is positioned between the flange and the shoulder 22 formed in the bottom part of the hollow interior 11 by the bore 12, and tends to urge the stem 15 in the upward outward direction. Fin-like projections 24 (only shown in Fig. 1) are provided on the inner wall of the valve housing 10 and project into the hollow interior 11. The upper ends of the projections 24 are at a level such that they are abutted by the flange 21 and act as stops for the downward movement of the stem 15.

On the exterior peripheral surface of the upper part of the stem 15 above the flange 21 are a plurality of radially projecting ribs 25 extending parallel to the axis of the stem, and defining between them passages 26 for the flow of product. At the lower ends of the ribs 25 and extending outwardly therefrom on the upper part of the flange 21 is a downwardly and outwardly tapered surface 28. Engaged with this surface 28 is the inner portion of the downwardly facing surface of a further annular obturating gasket 29 for obturating flow of the product. This gasket has the outer annular portion of its downwardly facing surface engaged with the upper end rim 27 of the valve housing 10, so that in the non-dispensing position, as shown in Fig. 1, the annular gasket 29 closes off the top of the hollow interior 11 between the stem 15 and the valve housing 10.

Extending downwardly from the hollow interior 11 on one side of the valve housing

10 is a product passage 34a which opens into a further downwardly open recess 34 in the bottom of the valve housing.

The valve stem 15 has an upper cylindrical or sleeve portion 37, which is integral with the outer edges of the ribs 25, and which extends upwardly beyond the end of the portion of the valve stem 15 having the hollow bore 17 therein. The interior of the sleeve portion 37 defines a larger upwardly opening recess 38 at the upper end of the valve stem 15. In the upper part of the valve stem bearing ribs 25 and opening into recess 38 within the sleeve portion 37 is a smaller upwardly opening recess 38a into which is fitted aspirating and dispensing means in the form of a nozzle insert generally indicated at 39 and being of the Venturi type. The nozzle insert 39 has a Venturi portion 40, which has the lower portion fitted into the recess 38a. The Venturi portion 40 is longer than the recess 38a is deep, and thus extends beyond the outer end of the recess 38a. The nozzle insert has a larger diameter portion 41 on the upper end thereof, the outer diameter of which fits tightly within the upwardly opening recess 38. This portion 41, together with the upper ends of the ribs 25, defines a product supply chamber 44. The Venturi nozzle insert 39 has a Venturi nozzle 40a therein, with radial product passages 42 opening into it through the Venturi portion 40 from the product supply chamber 44.

The piston-cylinder assembly comprises a cylinder 32, the upper end of which is in sealing engagement with said valve assembly around bore 12. In this embodiment it is engaged with the lower surface of the annular obturating gasket 14. The upper end of the cylinder 32 is thus closed by the gasket 14 and the stem head 16 extending through the gasket. The cylinder 32 has a flange 32a at the end thereof remote from the valve assembly. The outside diameter of the flange 32a is preferably about the same as the outside diameter of the valve housing 10.

A piston 45 is slidable in the cylinder 32 and a piston ring 46 is positioned in a groove around the piston. A piston rod 47 extends from the piston 45 out through the open end of the cylinder 32 and a pressure or push-button member 48 is mounted on the end of the rod. A vent bore or duct 49 extends through the rod and the piston. It may be controlled by a check valve (not shown).

There is defined between the flange 32a and the inner, lower end face of the valve housing 10 an annular recess 33 in which is positioned an annular flexible collapsible product-containing sac 35. The product-containing sac 35 has a discharge outlet 36 on the upper end thereof which extends upwardly and into sealing engagement with the valve housing in the recess 34 into which the product passage 34a opens.

Surrounding the above described parts and holding them in the described relationship is a casing, which, in this embodiment, is a two-part casing. The upper part 31 has an annular top flange 31a flanged over the upper surface of the annular gasket 29 and a bottom flange or crimp 31b turned into annular groove 10a provided in the outer peripheral side wall of the valve housing 10. The upper casing part 31 thus tightly clamps the valve housing 10 and the annular gasket 29 together. A lower casing part 30 has the upper end threaded to the valve housing 10 and extends downwardly so as to define the outer periphery of the annular recess 33 for the sac 35. The bottom 30a of the lower casing part extends inwardly and supports the flange 32a on the end of cylinder 32. The bottom has an opening 30b therein for piston rod 47. The lower casing part 30 also has openings 30c in the outer peripheral wall thereof to admit air to the annular recess 33 in which is positioned the product-containing sac 35.

Extending outwardly from the bottom of the lower casing part 30 are diametrically opposite finger grips 50, which, in this embodiment, are integrally formed with the casing part 30.

Actuator means are provided, which, in this embodiment, comprise an actuator sleeve 52 on the sleeve portion 37 of the valve stem 15. The actuator sleeve 52 has the upper end flanged over the end of the upper cylindrical portion 37, and has a laterally projecting flange 52a on the lower end thereof. Engaged with the flange 52a are two diametrically opposed levers 53 which are pivotally mounted on brackets 51 projecting from the top flange 31a of the upper casing portion 31. Pivottally connected to the free ends of the levers 53 is an actuator 54 which is a generally U-shaped frame which extends along the sides of the device and beneath the end of the lower casing portion 30, extending through apertures 50a in the finger grips 50. The closed bottom end of the actuator 54 has an aperture 54a therein through which the piston rod 47 extends.

In operation, starting with the parts in the positions shown in Figs. 1 and 2, the device is gripped by the finger grips 50, and a finger is placed over the end of the bore 49 opening out of the push-button member 48. A force is then exerted to force the piston 45 into the cylinder 32. This causes the air pressure in the cylinder to build up, the cylinder being closed at one end by the valve assembly and at the other end by the finger over the vent bore 49. This movement is continued until the piston nears the bottom of the cylinder, at which time the push-button member 48 abuts the actuator 54. At this point, the pressure within the cylinder has been built up to a maximum. Further move-

ment of the pressure member 48, in addition to moving the piston, also moves the actuator in the same direction the piston is moving. This causes pivoting of the levers 53 so as to move the actuator sleeve 52 toward the valve assembly, thus moving the valve stem 15 into the valve assembly.

Up to this point, the bore 17 in the stem has been sealed off from the interior of the cylinder 32 by the obturating gasket 14, which completely seals off the axial stem passages 20. In addition, the hollow interior 11 is sealed off from the passages 26 between the ribs 25 along the outside of the upper portion of the stem 15 by the gasket 29 and its sealing engagement with the tapered surface 28 on the upper part of flange 21 and with the upper end of the valve housing 10 around the hollow interior 11.

As shown in Fig. 3, upon movement of the valve stem 15 into the valve housing 10 by inward movement of the actuator sleeve 52, the hollow stem 15 moves downwardly through the hollow interior 11, two actions take place. One of these is the flexing downwardly of the obturating gasket 14, so that the upper surface around the hole there-through is engaged by the downwardly and inwardly tapered surface of the groove formed by the reduced diameter portion 19. The inner periphery of the obturating gasket 14 is moved away from the lower open ends of axial passages 20, thus opening a compressed-air flow path from the interior of cylinder 32 through the bore 17 to the Venturi portion 40 of nozzle insert 39.

Depending on the exact construction, slightly before or slightly after the opening of the passages 20, the downward flexing of the annular gasket 29 proceeds to a point where the downwardly and inwardly tapered portion of the lower end of the stem sleeve portion 37 engages the upper surface of annular gasket 29, and the inner periphery of the gasket 29 moves away from the tapered surface 28 on the upper part of flange 21. This establishes a product flow path from the central passageway (hollow interior) 11 through the passages 26 to the product supply chamber 44 which is sealed off from the atmosphere. The reduced pressure caused by expansion of the compressed air leaving the narrow Venturi nozzle duct 40a is thus communicated to this flow path through the radial product passages 42, and the product to be dispensed is aspirated from the product containing sac 35. Aspiration will continue until the compressed air in the cylinder 32 is exhausted.

As the product is aspirated from the product containing sac, the sac will collapse under the effect of the pressure of the atmosphere around the dispenser, which acts on the sac 35 through the openings 30b in the

lower casing part 30 and/or will collapse due to contraction of the sac material.

After completion of aspiration, release of the force on the actuator 54 for moving the hollow stem 15 inwardly of the valve assembly enables the return spring 23 to urge the hollow stem 15 to the rest position of Fig. 2, thereby returning the parts of the valve assembly to the position shown in Fig. 1.

The finger is then removed from the end of piston rod duct 49 and the rod 47 and piston 45 are drawn out of the cylinder to the Fig. 1 position.

It will be understood that the inward movement of the stem 15 is limited by the engagement of flange 21 with the projections 24 in the hollow interior of valve housing 10, and that movement of the stem 15 in the outward direction is limited by the engagement of the flange 21 with the gasket 29, which in turn is restrained by the top flange 31a on the upper casing part 31.

The dispenser device according to Figures 1 to 3 has many advantages. While the compression of the air is carried out gradually, the release of the compressed air occurs suddenly and only after compression has reached a maximum. Thus, the maximum aspiration effect is produced rather than a gradual aspiration, such as is produced with conventional squeeze bulb or piston-cylinder type atomizers. Moreover, the device is extremely compact, the casing parts 30 and 31 serving to hold most of the various parts together, and the use of the cylinder and piston enabling the provision of the product-containing sac in the recess defined thereby. The provision of the nozzle insert 39 within the upper end of the hollow stem makes this part compact and especially useful for dispensing a product in a direction substantially axially of the device. The use of the piston-cylinder arrangement eliminates the need for a compressed or liquefied propellant and a separate container therefor, which in turn eliminates any problems of compatibility of the propellant with the product being dispensed from the sac. In addition, it eliminates problems of shelf life of the device due to leakage of any such propellant container, and always assures reliable operation because there will always be a supply of air to be put under pressure to aspirate the product.

Because the amount of compressed air available for aspiration is inherently limited by the size of the device, it inherently dispenses a measured dose. By properly designing the piston-cylinder assembly and properly dimensioning the various orifices and flow paths within the valve assembly, it is possible to control the amount of the product dispensed. The amount of product dispensed depends mainly on the size of the piston chamber. This results in the delivery

of a specific amount of air, which in turn aspirates a specific quantity of product. The pressure created in the chamber depends mainly on the length of the piston stroke, and this pressure will affect the characteristics of the spray pattern of product delivered. If the structure is changed so that the size of the pressure chamber, i.e. the cylinder 32, remains constant, but the stroke of piston 45 is longer or shorter, the pressure created will be different, but the quantity of air delivered will remain about the same. Thus, the spray characteristics will change, but the quantity of product delivered will remain basically the same. Conversely, if the size of the pressure chamber is changed (increased or decreased in size) and the length of the piston stroke is kept the same, the characteristic of the spray pattern will remain generally the same, but the quantity of product delivered will either increase or decrease. Varying the size of the various orifices will also effect the spray pattern and delivery rates, and any desired spray pattern and amount of dispensed material can be obtained by proper design of the device.

Because of the fact that, depending on its design, the device provides only a predetermined amount of compressed air for aspirating, the device can never dispense more than a given amount during any one actuation cycle. The device is therefore inherently extremely safe for use in dispensing medicaments, for example. Oral inhalation of medicaments is made safer since only air and medicament, rather than potentially toxic propellants and medicament, are taken into the lungs.

Many variations in the construction of the device will be apparent. The casing containing the valve assembly has been described as having two parts, an upper part 31 and a lower part 30. This is for convenience in assembly, it being easier simply to flange under the flange 31b with the projections 51 in the desired position, and then screw the lower casing part 30 onto the valve housing 10. However, these two parts could be integral, and the cylindrical wall thereof simply indented into the groove 10a, or beneath the bottom of the valve housing 10.

The cylinder 32 has been shown as separate from the lower casing part 30. This makes it possible simply to position the cylinder against the gasket 14 and then screw the lower casing part onto the valve housing without it being necessary to turn the cylinder. This prevents the upper end of the cylinder 32 from cutting or scoring the gasket 14. However, these two parts could be made integral, and the casing 30 could be crimped into place.

The actuator means could be of different construction. For example, the valve assembly and casing could be placed in a holder

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having finger grips thereon with the end of the valve stem abutted against the holder, and the inner end of the cylinder shaped to block movement of the piston when it reaches the inner end. Engagement of the piston with the blockage would force the valve assembly toward the valve stem, with the same results as the movement of the valve stem into the valve assembly. Instead of having a simple duct blocked by the finger of the user, the piston could be provided with a check valve permitting flow of air only into the cylinder when the piston is being drawn out of the cylinder.

With reference now to the second embodiment of the invention as shown in Figures 4 to 8, the product container 60 contains a suitable product or products to be dispensed. Extending through product container 60 is a product container valve 61 having a valve stem 62. The detailed structure of the product container and valve will be explained in detail further below in connection with Figures 9 and 10. Suitable flow passages, shown in the latter Figures, provide communication between the interior of product container 60 and the valve stem 62. A coupler-aspirator unit 63 forming an upper part of the valve housing has therein first and second flow passages 64 and 65, respectively, which meet at a Venturi nozzle insert 66. The structure of the latter is shown in detail in Figures 9 and 10. The coupler-aspirator unit 63 is coupled to product container valve stem 62 to provide communication of first flow passage 64 therewith. Second flow passage 65 of coupler-aspirator 63 communicates with a chamber 67. A cylinder 68 having a chamber 69 therein is coupled to coupler aspirator unit 63. An inwardly extending flange 70 of cylinder 68 co-operates with the top of coupler-aspirator unit 63 to position a flexible annular gasket 71 therebetween (as shown in Fig. 7). A valve stem 72 is positioned displaceably within chamber 67 and 69. Stem 72 has a longitudinal channel 73 therethrough and radial openings 74 which extend axially into channel 73. The valve stem 72 is positioned in such a way that the inner periphery of gasket 71 obturates radial openings 74 in the non-dispensing or rest position.

A guide member 75 having vents 88 is adapted to fit over product container 60 by any suitable means such as a snap fit. The interior surface of guide member 75 has oppositely disposed ridges 76 thereon, and coupler-aspirator unit 63 has oppositely disposed contact and stop surfaces in the form of notched wing portions 63a connected by bridge portions 63b. The notches of wing portions 63a are adapted to contact and rest upon ridges 76 of guide member 75 to provide support for coupler-aspirator unit 63.

An elongated piston 77 is positioned to

slide within cylinder 68. Extending longitudinally through the extension 77a forming a piston rod of piston 77 is an air return passage 78. Integral with the top of piston rod 77a is an outwardly extending flange 79 which, together with a downwardly extending cylindrical flange 79a which is concentric around piston 77, forms an actuating member 80. The outer periphery of downwardly extending flange 79a is laterally supported by the interior wall of guide member 75. The bottom edge of downwardly extending flange 79a is bevelled to provide a contact surface 80a which is adapted to mate with a bevelled surface 63c of winged portions 63a of coupler-aspirator unit 63. A spring 81 is provided to urge piston 77 in the upward direction as shown in Figures 4 and 5. Alternatively, handles 82 may be formed integrally with actuating member 80 such that the piston 77 might be manually moved upwardly thereby eliminating the need for spring 81. As shown in Fig. 5, coupler-aspirator unit 63 extends to and in use sprays an opening 75a in guide member 75.

The operation of the dispenser of Figures 4 to 8 of the present invention will now be described. The unit is generally grasped around guide member 75. The operator places a thumb or finger over air return passage 78 and applies force thereby in the general direction of arrow 83 to the actuating member. This causes piston 77 to be moved downwardly in chamber 69 of cylinder 68 thereby compressing the air therein. As the bottom of piston 77 reaches the bottom of chamber 69, valve stem 72 is forced downwardly. As will be apparent from Fig. 7, radial openings 74 are thus unblocked. The compressed air within chamber 69 is thus in communication through passage 73, radial openings 74, chamber 67, and second flow passage 65 into nozzle 66. Also, as piston 77 moves downwardly, flange 79a moves downwardly. When contact is made between bevelled edge 80a of flange 79a and bevelled edges 63c of wing portions 63a, the wing portions are forced inwardly. Further force applied to actuating member 80 causes coupler-aspirator unit 63 to be moved downwardly through contact with cylinder 68. This forces valve stem 62 downwardly, thereby opening product container valve 61. Communication of the product or products is thus open through stem 62 and first flow passage 64 into nozzle 66. The product is thus aspirated through the coupler-aspirator by the compressed air. A clearance is provided between the inner surface of guide 75 and the outer surface of flange 79a to allow air compressed within guide 75 during descent of the actuating member to escape. Opening 75a also serves this purpose. However, although as shown, additional apertures 88 in guide member 75 are provided

for this purpose, these apertures 88 may be dispensed with. Upon removal of the force 83, the actuating member is moved upwardly to its original position either by the force of spring 81 or manually by means of handles 82. As piston 77 is moved upwardly within chamber 69, a partial vacuum will be created therein. However, air return passage 78 allows access of atmospheric air to equalize the pressure in chamber 69.

It is to be understood that when the product or products have been exhausted, the remainder of the dispensing system may be transferred to a new product container 60, or the present product container 60 may be refilled.

It is to be further understood that all of the various elements of the various embodiments of the present invention may be made of any convenient or desirable material such as plastics. These elements can easily be made by conventional moulding techniques, thus making possible the provision of such a device at a low cost.

It is to be further understood that the quantity of product delivered in use by the dispenser according to the second embodiment of this invention can easily be controlled by modifying the size of piston chamber 69, thereby enabling compression of more or less air. Also, the sequence of opening of the valves may be controlled by modifying the length of piston 77 with respect to that of flange 79a. That is, flange 79a may be lengthened relative to piston 77, whereby product container valve 61 is depressed before the valve stem 72.

It is to be still further understood that although the seal between cylinder 68 and piston 77 has been disclosed as a sliding friction fit, the desired fit may be achieved with gaskets. Also, even though the various elements of the air compressing assembly in the two embodiments of the invention have been shown as cylindrical, it is to be understood that these elements could have any desired shape generated by a straight line moving parallel to an axis, for instance, a rectangular shape.

The product container 60 and valve 61 of the second embodiment of the invention will now be described in detail in connection with Figures 9 and 10 of the drawings.

As shown in Figure 9, the product container comprises an outer container 91 which is adapted to contain a flexible product sac 92 enclosing a suitable product to be dispensed therefrom. Sac 92 may be made of any suitable material which is compatible with the product to be dispensed. Product container 91 may also be made of any suitable or desirable material such as a plastics, metal, fibreboard, etc. A product container

valve 61 is seated in valve collar 55. Valve collar 55 is sealed to container 91 in any conventional manner. The seal between collar 55 and container 91 need not be a pressure seal or leakproof seal since container 91 does not house a propellant and the product is contained in a sac. The interior of sac 92 is in communication with a product flow path within valve 61 in a conventional manner, one example of which will be described in detail below.

The outlet of product container valve 61 is in communication with the first flow passage 64 in the coupler-aspirator unit 63. First flow passage 64 and second flow path 65 join in a Venturi nozzle 66 from which the product is sprayed. Second flow path 64 is adapted to communicate with the valve stem 62. Container 91 is provided with holes 57 in any suitable location for the purpose of providing air vents in the container. Holes 57 allow equalization of atmospheric pressure within container 91 and around product sac 92. Thus, as product is dispensed from sac 92, the pressure is equalized therearound to ensure complete or continued dispensing.

As previously mentioned, product container valve 61 may be any suitable conventional device. One example of such a valve is shown in Fig. 9 and will now be described. Valve collar 55 has a central opening 56 therein. Just below opening 56 annular gasket 57 is supported on a valve body 58 being the lower part of the valve housing. A crimp 59 in collar 55 acts to retain valve body 58 in place and to hold gasket 57 in place. Flexible product sac 92 is connected to a sac adaptor 94. Sac adaptor 94 extends through and is held in place by the inner periphery of valve body 58. Slidably mounted within annular chamber 95 in the interior of valve body 58 is the valve stem 62. Stem 62 has therein a longitudinal passage 97 which communicates at its lower end with a radial passage 98. Radial passage 98 extends to the outer surface of valve stem 62. A spring 99 urges valve stem 62 in an upwardly closed position. In this closed position the inner periphery of gasket 57 closes radial hole 98.

When an operator pushes down actuating member 80 and together therewith the coupler-aspirator unit 63 this pressure is transferred to valve stem 62. As stem 62 is pushed down against the force of spring 99, radial opening 98 becomes clear of gasket 57. Communication is then opened between the interior of product sac 92, sac adaptor 94, chamber 95, radial opening 98, longitudinal passage 97, flow passage 64, and nozzle 66. Thus, it will be apparent that as actuating member 80 is depressed, both the compressed air valve in cylinder flange 70 and the product container low pressure valve

are opened. Only pressure sufficient to open the stiffer of these two valves is required. When both valves are opened the propellant will aspirate the product through the above-mentioned path and cause it to be sprayed from nozzle 66.

In the dispenser shown in Fig. 9, the product is enclosed in a flexible product sac. Thus, the product container may be provided with various holes 55a therein to ensure equalization of pressure within the product container further to provide for continued dispensing of the product from the sac. As previously mentioned, it is also possible to enclose the product within the product container itself, rather than in a flexible product sac. However, it is manifest that if such arrangement is made, the pressure equalization holes may not be provided in the product container and the seal of the collar to the product container must be leak-proof.

Therefore, with reference now to Fig. 10, a further embodiment of the present invention will be described wherein the product is located within the product container and means are provided within the valve for pressure-equalization within the product container. The product 103 is enclosed within product container 101. Dip tube 102 extends into the product and is fitted into socket 104 of annular valve body 112. Valve body 112 is supported on the inner periphery of a downwardly extending projection 105a of collar 105. Gasket 111 is held in place between collar 105 and annular valve body 112. Collar 105 is sealed to container 101 in a conventional manner to provide a leak-proof seal. Slidably mounted within annular chamber 108 of annular body member 112 is a valve stem 109. Radial openings 106 extend from a longitudinal center passage 107 of stem 109 into chamber 108. Gasket 111 has the inner periphery thereof obturating the radial openings 106 and thus serves as a low pressure obturator. Annular depending projection 105a has a longitudinal opening 105b therein.

In the non-dispensing position, spring 114 urges the head part 113 of valve stem 109 against gasket 111.

As the unit is actuated and stem 109 is depressed, gasket 111 is moved downwardly. This of course, opens communication between product in product container 101 through dip tube 102 into chamber 108 through openings 106 and into passage 107. Simultaneously however, gasket 111 is moved away from projection 105c of collar 105, and there is then communication between the atmosphere above collar 105 and the interior of container 101 through opening 105b. Thus, as product is aspirated from the interior of container 101, atmospheric pressure is introduced into container 101

to equalize the pressure therein, and to thus ensure continued dispensing of the product therefrom.

The construction of the coupler-aspirator unit is the same as that disclosed with regard to the embodiment of Figures 4 to 9.

Figures 11 and 12, which illustrate the second aspect of the invention show the dispenser as part of an impregnating device especially adapted for impregnating cigarettes.

The dispenser in this impregnating device is basically the same as that shown in Figs. 1 to 3. The piston rod is a hollow cylindrical member 120 having a check valve 121 in the piston end thereof for preventing air from escaping during movement of the piston into the cylinder, and allowing air to enter the cylinder during withdrawal of the piston from the cylinder. The flange 132a on the cylinder 132 is not as large, and the lower casing part 130 has the openings 130b into the sac-containing recess 133 in the bottom wall, rather than in the side wall. The actuator 148 comprises a cylindrical sleeve forming a cup-shaped extension at the free end of the piston rod 120 and has holes 148c in the end wall thereof to permit passage of air into and out of the actuator 148 during movement of the piston in and out of the cylinder 132. Engagement of the end of the actuator 148 with the end of cylinder 132 moves the valve housing comprised in the valve assembly 110.

The impregnating part of the device has a hollow cylindrical article holder 170, here shown as having a generally cylindrical interior 170a of a size to hold a single cigarette C. The article holder 170, which is a narrower member of a telescopic system and is telescopable into a wider member 180 serving as a vacuum cylinder, has a retaining ledge 171 on the inside thereof against which the bottom end of the cigarette rests, and has a cover 172 with a cover actuator 173 extending therefrom pivoted on a pivot 174 on an ear 175 attached to a cover supporting ring 176 threaded to the top of the article holder 170. The cover 172 is adapted to rest in sealing engagement with the end of the article holder 170, and has a projection 172a extending into the interior of the article holder and adapted to engage the cigarette C to hold it in position in the article holder against the retaining ledge 171 so that it will not move when it is subjected to a stream of gas.

On the opposite end of the article holder from the cover 172 is a vacuum piston head 177 having a ring groove 178 in the outer periphery thereof and a sealing ring 179 therein. Around the piston head 177 is disposed the above-mentioned vacuum cylinder 180, the interior of which is in sliding sealing engagement with the piston head 177 and

sealing ring 179. Mounted on the upper end of the vacuum cylinder 180 is an annular vacuum piston 181. On its inner peripheral surface, this piston 181 is provided with a ring groove 182 with a sealing ring 183 therein. The inner peripheral surface of the annular vacuum piston 181 and the sealing ring 183 are in sliding sealing engagement with the exterior cylindrical surface of the article holder 170.

It will be seen that when the article holder 170 and the vacuum cylinder 180 are moved relative to each other in a telescoping fashion, i.e. when the article holder is slid into the vacuum cylinder, an expanding chamber 184 is formed between the piston head 177 and the annular piston 181. This expanding chamber 184 is used to supply a vacuum, as will be explained hereinafter.

Passages are formed in the article holder 170, which extend from the interior thereof into the chamber 184. In this embodiment the openings 186a establish free communication between the interior 170a of the article holder 170 and the chamber 184 only when the latter is fully expanded, due to the fact that these openings 186a are located near the upper end of the article holder 170, which is remote from the piston head 177, as shown in Fig. 12. Thus, as the article holder 170 is telescoped into the vacuum cylinder 180, the vacuum in the expanding chamber 184 increases, reaching a maximum just before the annular piston 181 passes the openings 186a. By placing the openings 186a a distance above the piston head 181, which is substantially the same as the distance between the bottom of the cylinder 132 and the end of the actuator 148, which actuator is attached with its outer rim 148a to the lower end portion of vacuum cylinder 180, and when the cylinder 180 and article holder 170 are in fully telescoped position, the end wall of the actuator 148 will engage the end of the cylinder 132 at about the time as the annular piston 181 reaches the openings 186a.

A dispenser-receiving recess 188 is provided in the bottom of the piston head 177 of article holder 170 and is in communication with the interior 170a of the article holder. The recess 188 is adapted to receive in a snug fit therein the end of the upper sleeve portion 37 of the valve stem 15 through which the material to impregnate the article is dispensed.

Details of the valve stem 15, the sleeve portion 37, and all other structural parts of the valve assembly have been described hereinbefore in connection with Figures 1 to 3. In the Figures 11 and 12 these parts are shown as a valve assembly 110 without detail.

Mounted on the bottom of the piston head 177 are release means for holding the dis-

penser unit away from the impregnating part of the device until the pressure is built up in the cylinder 132. In this embodiment, they are in the form of fingers 190 pivotally mounted on projections 191 on the bottom of the piston head 177. The fingers have cam heads 190a on the inner ends thereof which bear against the top of the upper casing part 131 of the dispensing unit, and the outer ends of the fingers extend outwardly of the outer periphery of the dispensing unit and normally bear against the inner surface of the vacuum cylinder 180. The cam heads 190a have a shape such that in their normal position they bear against the top of the dispenser unit and space the latter away from the piston head 177 a distance such that the valve stem 15 is in the raised or non-dispensing position. The enlarged portion 148b which comprises the cup rim 148a provided on the end of the actuator 148 receives the fingers 190 when the vacuum cylinder is fully telescoped in relation to the article holder 170. The last part of the movement of the actuator 148 swivels the fingers 190 upwardly, turning the cam heads 190a so that they bear on the bevelled edge 131d of the upper casing portion 131, as shown in Fig. 12. This permits the distance between the impregnating part and the dispensing device to be decreased sufficiently to move the valve stem 15 into the valve housing 10 to bring about dispensing (see Figure 3).

In operation starting from the device in the non-impregnating position shown in Fig. 11, and with a cigarette C having been positioned in the interior 170a of the article holder 170 and the cover 172 being closed, the article holder 170 and the actuator 148/vacuum cylinder 180 assembly are telescoped. During the relative movement between them, the chamber 184 expands to produce a vacuum as described above. In the meantime, piston 145 is being forced into cylinder 132 to increase the pressure therein. The movement continues until the piston 145 abuts the bottom of the cylinder 132, at which time the actuator 148 is near the inner end of the cylinder 132. Further movement of the article holder 170 and the actuator 148 towards each other causes the release means to be actuated and fingers 190 thereof to move outwardly into the enlarged actuator cup portion 148b. The dispenser unit can then move toward the impregnating unit to cause the valve stem 15 to be moved toward the valve housing 10 for dispensing of the product to be dispensed by aspiration by the compressed air. The dispensing unit will be actuated to discharge material at the time the openings 186a are placed in communication with the expanding chamber 184. Thus, as the air is being drawn from the interior 170a of the article holder 170

at the upper end, the material to impregnate the cigarette C is being discharged into the interior 170a at the lower end.

5 With this arrangement, in order to enable the article holder 170 and the vacuum cylinder 180 to be drawn apart, some way must be provided for venting the air which will be present in the expanding chamber 184 after the openings 86a have been opened. 10 One simple way of accomplishing this is to provide vent openings 187 in the cylinder 180 just below the annular piston 181, and to cover the outer ends of these openings with a flap valve 189, here shown as an annular rubber band in a groove 181a. During expansion of the expanding chamber 184, the rubber band will be drawn tightly against the opening 187, preventing inflow of air, but 15 while the chamber is being made smaller, the rubber band can stretch and allow air to flow out of the chamber 184.

After impregnation, the cover 172 is opened and the cigarette removed.

25 When the dispensing device is empty, it can easily be replaced by simply unscrewing the actuator 148 from the vacuum cylinder 180. The apparatus is again ready for operation.

30 The combination of the impregnating device and the dispensing device has all of the advantages of the dispensing device *per se*, as discussed above, and provides a compact and reliable source of impregnating material for the impregnating device.

35 It will be appreciated that although the terms "upper", "lower", "top" and "bottom" have been used in describing the device according to the invention, these terms have been used for convenience in referring to the device in the position in which it is shown 40 in the drawings, and are not intended to be any limitation of the position in which the device can be used.

45 The terms "cylinder" and "cylindrical" as used throughout the specification are by way of example. The invention not intended to be limited to right circular cylinders, but is intended to include any desired symmetrical shape generated by a straight line moving parallel to an axis, so that the cross-section of the cylinder can be circular, square, triangular, or any other such geometrical shape. Likewise, the term "annular" is used by way of example.

55 It will also be appreciated that while the seals between the various pistons and cylinders have been shown as gaskets sliding along the walls thereof, these gaskets can be omitted in many instances and replaced by 60 friction fits between the parts.

WHAT WE CLAIM IS:—

1. An aerosol dispenser comprising at least one product container, a manually operable piston pump for producing compressed air

to serve as propellant, a dispensing nozzle means through which, in use, compressed air flows and aspirates the product(s) from said container(s), a valve assembly for controlling the flow paths of the product(s) and the compressed air; the valve assembly including a valve housing, a displaceable valve stem which is in engagement with respective obturators for the product(s) and the compressed air, the piston of the pump having rigidly connected thereto an abutment surface so disposed as to abut an actuator for the displaceable valve stem at the end of the compression stroke of the piston, the abutment causing the displacement of the valve stem and thus the opening of at least that obturator which controls the flow of compressed air.

2. Aerosol dispenser according to claim 1 wherein, for opening the obturator(s) for the product(s), the piston having rigidly connected thereto a contact surface which is adapted to move with the piston towards a position where it mates with a surface of a stop member forming part of the valve controlling the opening of the product container(s), further movement of the piston releasing said stop member and causing said valve to open.

3. Aerosol dispenser according to claim 1 or claim 2 wherein the obturator for compressed air includes a flexible annular gasket which is clamped between the cylinder of the piston pump and a coupling member bearing said nozzle means and coupling the product container(s) to the piston.

4. Aerosol dispenser according to claim 1 wherein said dispensing nozzle means comprise a spray nozzle mounted on that end of the valve stem which is remote from the piston, and so disposed in the dispenser, that the product is, in use, sprayed out of the spray nozzle in the axial direction of the valve stem and the piston movement.

5. Aerosol dispenser according to any preceding claim wherein rigid mechanical transmission means are provided to transmit the abutment force between said surface and said actuator to the valve stem.

6. Aerosol dispenser as claimed in claim 5 wherein said actuator comprises a sleeve means engaging said valve stem as well as at least two levers, a first one thereof being pivotally mounted on said valve housing and engaging said sleeve means, and the second lever being pivotally mounted at a free end of said first lever and engaging said actuator so as to be moved thereby at an intermediate position of said piston in said cylinder.

7. Aerosol dispenser as claimed in claim 6, wherein said second lever extends about said container and said cylinder at least partially surrounded by the former and is provided at its end remote from its pivot

at the upper end, the material to impregnate the cigarette C is being discharged into the interior 170a at the lower end.

With this arrangement, in order to enable the article holder 170 and the vacuum cylinder 180 to be drawn apart, some way must be provided for venting the air which will be present in the expanding chamber 184 after the openings 86a have been opened. One simple way of accomplishing this is to provide vent openings 187 in the cylinder 180 just below the annular piston 181, and to cover the outer ends of these openings with a flap valve 189, here shown as an annular rubber band in a groove 181a. During expansion of the expanding chamber 184, the rubber band will be drawn tightly against the opening 187, preventing inflow of air, but while the chamber is being made smaller, the rubber band can stretch and allow air to flow out of the chamber 184.

After impregnation, the cover 172 is opened and the cigarette removed.

When the dispensing device is empty, it can easily be replaced by simply unscrewing the actuator 148 from the vacuum cylinder 180. The apparatus is again ready for operation.

The combination of the impregnating device and the dispensing device has all of the advantages of the dispensing device *per se*, as discussed above, and provides a compact and reliable source of impregnating material for the impregnating device.

It will be appreciated that although the terms "upper", "lower", "top" and "bottom" have been used in describing the device according to the invention, these terms have been used for convenience in referring to the device in the position in which it is shown in the drawings, and are not intended to be any limitation of the position in which the device can be used.

The terms "cylinder" and "cylindrical" as used throughout the specification are by way of example. The invention not intended to be limited to right circular cylinders, but is intended to include any desired symmetrical shape generated by a straight line moving parallel to an axis, so that the cross-section of the cylinder can be circular, square, triangular, or any other such geometrical shape. Likewise, the term "annular" is used by way of example.

It will also be appreciated that while the seals between the various pistons and cylinders have been shown as gaskets sliding along the walls thereof, these gaskets can be omitted in many instances and replaced by friction fits between the parts.

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1. An aerosol dispenser comprising at least one product container, a manually operable piston pump for producing compressed air

to serve as propellant, a dispensing nozzle means through which, in use, compressed air flows and aspirates the product(s) from said container(s), a valve assembly for controlling the flow paths of the product(s) and the compressed air; the valve assembly including a valve housing, a displaceable valve stem which is in engagement with respective obturators for the product(s) and the compressed air, the piston of the pump having rigidly connected thereto an abutment surface so disposed as to abut an actuator for the displaceable valve stem at the end of the compression stroke of the piston, the abutment causing the displacement of the valve stem and thus the opening of at least that obturator which controls the flow of compressed air.

2. Aerosol dispenser according to claim 1 wherein, for opening the obturator(s) for the product(s), the piston having rigidly connected thereto a contact surface which is adapted to move with the piston towards a position where it mates with a surface of a stop member forming part of the valve controlling the opening of the product container(s), further movement of the piston releasing said stop member and causing said valve to open.

3. Aerosol dispenser according to claim 1 or claim 2 wherein the obturator for compressed air includes a flexible annular gasket which is clamped between the cylinder of the piston pump and a coupling member bearing said nozzle means and coupling the product container(s) to the piston.

4. Aerosol dispenser according to claim 1 wherein said dispensing nozzle means comprise a spray nozzle mounted on that end of the valve stem which is remote from the piston, and so disposed in the dispenser, that the product is, in use, sprayed out of the spray nozzle in the axial direction of the valve stem and the piston movement.

5. Aerosol dispenser according to any preceding claim wherein rigid mechanical transmission means are provided to transmit the abutment force between said surface and said actuator to the valve stem.

6. Aerosol dispenser as claimed in claim 5 wherein said actuator comprises a sleeve means engaging said valve stem as well as at least two levers, a first one thereof being pivotally mounted on said valve housing and engaging said sleeve means, and the second lever being pivotally mounted at a free end of said first lever and engaging said actuator so as to be moved thereby at an intermediate position of said piston in said cylinder.

7. Aerosol dispenser as claimed in claim 6, wherein said second lever extends about said container and said cylinder at least partially surrounded by the former and is provided at its end remote from its pivot





with a catch means adapted for being engaged by said pushbutton means of said piston rod, whereby said pushbutton means lifts said second lever, beginning from an intermediate position of said piston in said cylinder, thereby shifting said first lever to move said valve shaft via said sleeve means toward the interior of said valve housing, and thereby to actuate said obturators to open said flow paths for compressed air flowing from said cylinder, and for product from said container, to said dispensing nozzle means.

8. Aerosol dispenser as claimed in any one of claims 4 to 7, wherein the cylinder of the piston pump is connected with its open end located at the compression side thereof, to a front face of said valve housing and that the container for the product is connected to a wall of said valve housing opposite said front face, that the dispensing nozzle is mounted in or on a lateral wall of said valve housing.

9. An aerosol dispenser as claimed in claim 5 wherein the dispenser comprises a narrower and a wider member in telescopable association with each other, said narrower member having a smooth exterior surface and being provided at its one end with a piston head located inside a cavity of said wider member, and the latter member being slidable on said piston head and having a circumferential piston at its end surrounding said narrower member, which piston has an internal periphery complementary in shape to and in sliding engagement with said smooth exterior surface on said narrower member, said narrower member being an article holder the hollow interior of which is sealable against the outside and said wider member being connected with the actuating means of an aerosol dispenser unit adapted for dispensing into the interior of said article holder a gaseous substance with which an article held in said interior is to be impregnated.

10. An aerosol dispenser as claimed in claim 9, wherein said aerosol dispenser is positioned in the cavity of said wider member for displacement therein, and with the valve stem protruding from said container body on the side of the latter facing said article holder, and the latter is provided with a recess adapted for receiving the protruding end of said valve stem therein and being connected to the hollow interior of the article holder.

11. An aerosol dispenser as claimed in claim 9 or claim 10 wherein said air-compressor piston is mounted on a separable bot-

tom portion of said wider telescopable member and that said dispenser unit is disposed slidably therein with said air-compressor piston adapted to be displaceable in said cylinder.

12. An aerosol dispenser as claimed in claim 11 wherein release means are provided between said piston head and said valve assembly and normally holding them spaced from each other; and switch means are provided at said wider telescopable member for moving said release means to permit said dispenser to move toward said article holder to move said valve stem relative to said valve housing for causing said obturating means to open said flow paths when said air compressor piston is moved to the inner end of said cylinder adjacent said valve assembly due to said wider member being moved in telescoping movement relative to said article holder.

13. An aerosol dispenser as claimed in claim 12, wherein said release means comprise a pair of release fingers pivotally mounted on the bottom of said piston head and having cam heads on the ends thereof toward said valve stem, the outer ends of said fingers extending outwardly and bearing against the inner surface of said wider telescopable member, said cam heads having a shape such that with the fingers engaged with the wall of the wider member, the piston head is spaced from the valve assembly a distance such that the valve stem is in a position in which the flow paths are obturated, and, when the fingers are freed from the inner wall of the wider member by said switch means engaging said fingers and pivoting them, the valve assembly is free to move toward the piston head.

14. An aerosol dispenser as claimed in any one of claims 11 and 13 wherein said separable bottom portion is removably attached to said wider member, whereby the bottom portion can be detached from said wider member and the valve assembly, cylinder and product container can be replaced.

15. An aerosol dispenser substantially as hereinbefore described with reference to and as shown in Figures 1—10 of the accompanying drawings.

16. An aerosol dispenser substantially as hereinbefore described with reference to and as shown in Figures 11 and 12 of the accompanying drawings.

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